

Temporomandibular Joint Replacement Using Stock Alloplastic Graft in the Treatment of Ankylosis- A Case Report

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ABSTRACT

Introduction: This paper aims to assess the suitability and effectiveness of temporomandibular joint replacement (TMJR) devices to treat a case of re-ankylosis and association of tuberculosis (TB) with reduced mouth opening.

Traditional protocols for the treatment of temporomandibular joint (TMJ) ankylosis have preferred autologous grafts for reconstruction. Usage of TMJR devices have been reserved for very specific conditions.

Case report: We present a case of a patient previously treated for ankylosis using a sternoclavicular graft, who came with a chief complaint of progressive decrease in mouth opening. She also gave a history of pulmonary TB a year back. Investigations revealed no active TB. Images and clinical presentation were consistent with bilateral ankylosis.

The treatment plan consisted of resection of ankylotic mass on the left side and removal of the failed graft and reconstruction with Biomet stock TMJR prosthesis on the left side.

Discussion: Stock device has proven to be reliable option in planned TMJR procedures. Osteoarticular TB should be ruled out in patients with a history and features of TB.

Conclusion: Stock TMJR devices are an effective and viable option for the treatment of re-ankylosis. This ensures almost immediate possibility of physiotherapy and long-term results including maintenance of mouth opening and function. Osteoarticular TB can cause trismus and painful joints which may be misdiagnosed. Any patient with reduced mouth opening with a history of TB should be investigated for possible extrapulmonary TB.

Keywords: Ankylosis, Biomet Stock devices, Temporomandibular Joint replacement.

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INTRODUCTION

Temporomandibular joint (TMJ) is a pathologic condition that causes limitation in jaw motion causing esthetic and functional problems with trauma (31–90%), infections (10–35%) and certain systemic diseases as common etiological factors. Alloplastic temporomandibular joint replacement (TMJR) is often considered as the final treatment modality in the management of TMJ pathologies with strict guidelines and indications for usage. Alloplastic TMJRs have been used with reliable, safe and successful quality of life outcomes.^{1–7}

Three commonly used TMJR systems are TMJ Concepts (Ventura CA, USA), TMJ Implants/Christensen (Golden, CO, USA) & Biomet/Lorenz (Jacksonville, FL, USA). Authors claim that custom devices are better suited in cases with large defects with complex occlusal variables. The customization allows for greater stability by ensuring a close fit which limits micromovements and need for bending or “adjusting” the prosthesis which ultimately leads to better survival rates after functional loading. However, several studies have shown TMJ Concepts and Biomet systems to be effective with acceptable and comparable results and outcomes.^{4–9}

The Biomet™ system is a stock device that comes in fixed and predetermined sizes. It has a fossa component and a mandibular component. These come in three sizes and the latter is available in two shapes—narrow and standard. Based on the 3D models and virtual planning, the right stock device was selected. The fossa component is made of ultra-high molecular weight polyethylene and the mandibular component is made of cobalt

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Patient consent and ethical statement: The authors certify that they have obtained all appropriate patient consent forms. In the form, the patient(s) has/have given his/her/their consent for his/her/their images and other clinical information to be reported in the journal. The patients understand that their names and initials will not be published and due efforts will be made to conceal their identity, but anonymity cannot be guaranteed.

The preparation of this manuscript conforms to CARE case report guidelines.

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Figs 1A to C: Pre-op clinical photos

chromium with titanium layer sprayed on the surface that adapts to the bone.⁵

TMJ ankylosis is a pathological condition leading to limitation in jaw movements causing masticatory, aesthetic, functional, psychological, and growth disorders. Several techniques have been described in the literature to manage this condition. The ideally reconstructed joint should ideally replicate the form and function of the condyle.⁷ This report presents a case of TMJ re-ankylosis treated with alloplastic Biomet™ TMJ system. The patient also suffered from tuberculosis (TB) for which she was under medication and was currently completely in remission. Extra-pulmonary TB in the TMJ is pretty rare and very few cases have been documented. TB of the TMJ generally shows tubercular involvement in the cancellous portion of the condyle and may present as a painful or pain-free swelling that may lead to difficulty in mouth opening.¹⁰⁻¹² This report also aims to explore the probable effects of TB infection in TMJ.

CASE REPORT

A 26-year-old female patient reported to our department in Bengaluru city, Karnataka, India in the month of April, 2017 with a chief complaint of progressive difficulty in mouth opening since the last 1 year. She gave the history of a road traffic accident (RTA) she met in February of 2001 when she was 10 years of age. She reported that after the accident, she had difficulty in opening her jaws which progressively worsened and also noticed a deviation of her jaw toward the right. In March 2002, she then visited a dental college and hospital where she was diagnosed with unilateral ankylosis in the right TM joint. Considering her history and pre-trauma photographs, it was assumed that the ankylosis was because of the RTA. Following established protocols, she was treated with interpositional arthroplasty using sternoclavicular graft and acceptable postsurgical results were obtained.

She gave the history of TB 18 months back for which she took treatment as per the RNTCP (National Tuberculosis Elimination Program) protocol for new TB cases. She was on Isoniazid, Rifampicin, Pyrazinamide and Ethambutol in daily dosages as per appropriate weight band category for 8 weeks in the intensive phase, followed by Isoniazid, Rifampicin and Ethambutol for 16 weeks in the continuation phase. At the time of examination, she was in post-lateness “cured” phase and had completed the full course of treatment

and had returned two consecutive negative sputum smear results. Clearance was obtained by the pulmonologist stating the same.

On examination, jaw opening was recorded to be 5 mm. Extra-oral findings revealed gross facial asymmetry with typical ‘bird face’ appearance (Fig. 1). Lips were incompetent and the mandible was retrognathic. Bilateral antegonial notch was observed on both sides with more prominence on the left side. Obtuse mentolabial sulcus was recorded along with corresponding increased mentolabial angle and thyromental distance. Intra-oral examination revealed Class I molar relation bilaterally. OPG and CT scans revealed (Fig. 2) type II Sawhney’s⁶ ankylosis in the left joint and Sawhney’s⁶ type III bony ankylosis in the right joint. Virtual planning was done and 3D study models were obtained to plan the surgery to ensure customization and proper fit of the Biomet™ TMJR system prosthesis (Figs 3 and 4). The Biomet™ stock system was chosen because the preoperative analysis showed a good fit with it and for economic reasons.

Informed consent was obtained from the patient and standard preoperative protocols were followed. The joint region on the left side was accessed through a pre-auricular approach. The ankylotic mass was identified and removed, and the native condylar segment was shaved to achieve proper shape. Coronidectomy was performed on the left side to ensure good mouth opening.

The surgical approach on the right side was through Alkayat and Bramley’s incision and the Risdon’s submandibular approach. The ankylotic mass was identified and removed till the level of the sigmoid notch to create room to fit the fossa prosthesis. A diamond bur was used to flatten the eminence and shape it to the contour matching the fossa component. Following this, the fossa component was installed by fixing it to the zygomatic arch using titanium screws. (Fig. 5) The patient was then put on intermaxillary fixation (IMF).

Since this was a case where previous reconstruction was done with sternoclavicular graft, subsequent osteotomy/osteoplasty to shape the remaining mandibular segment to receive the stock prosthesis was a critical and challenging step to ensure correct fit of the mandibular component. After verifying the positioning and ensuring that the mandibular component had a flat stable base on the native bone, the mandibular component was installed and fixed on the lateral ramus of the mandible, with care taken to seat the condyle as posteriorly as possible on the fossa component. Intra-op mouth opening was recorded at 30 mm.

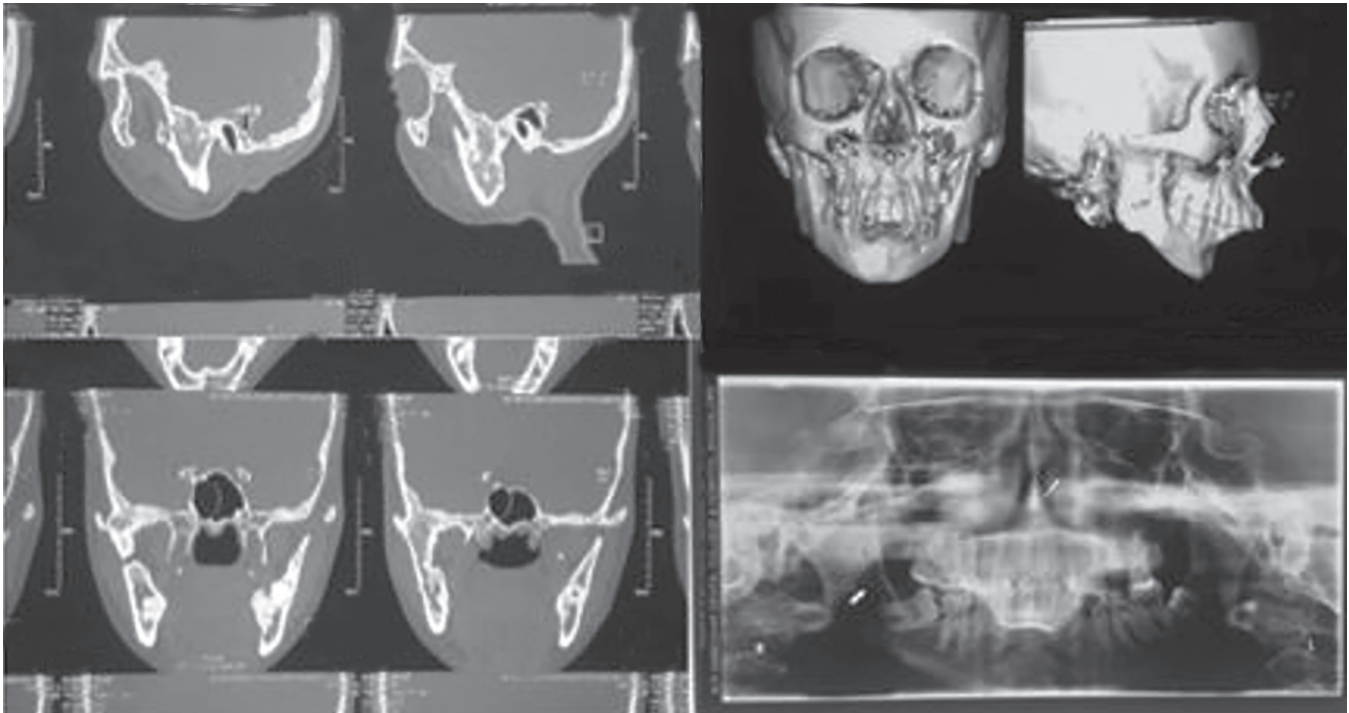


Fig. 2: Preoperative images: Clockwise from R-L: CT sagittal section, 3D reconstruction images, OPG, CT coronal section



Fig.3: Stereolithographic models with mock work-up

The operative sites were thoroughly washed with povidone-iodine and saline solution. Closure was done layer-wise appropriately to ensure good cosmesis in the future. The patient was not kept on IMF in the postoperative phase, and jaw opening

exercises were advised 2 days after surgery. The patient was put on appropriate IV antibiotics for 7 days postsurgery. The patient was discharged on the 10th postoperative day. Follow-ups were done after 1 month, 3 months, 6 months, and 12 months



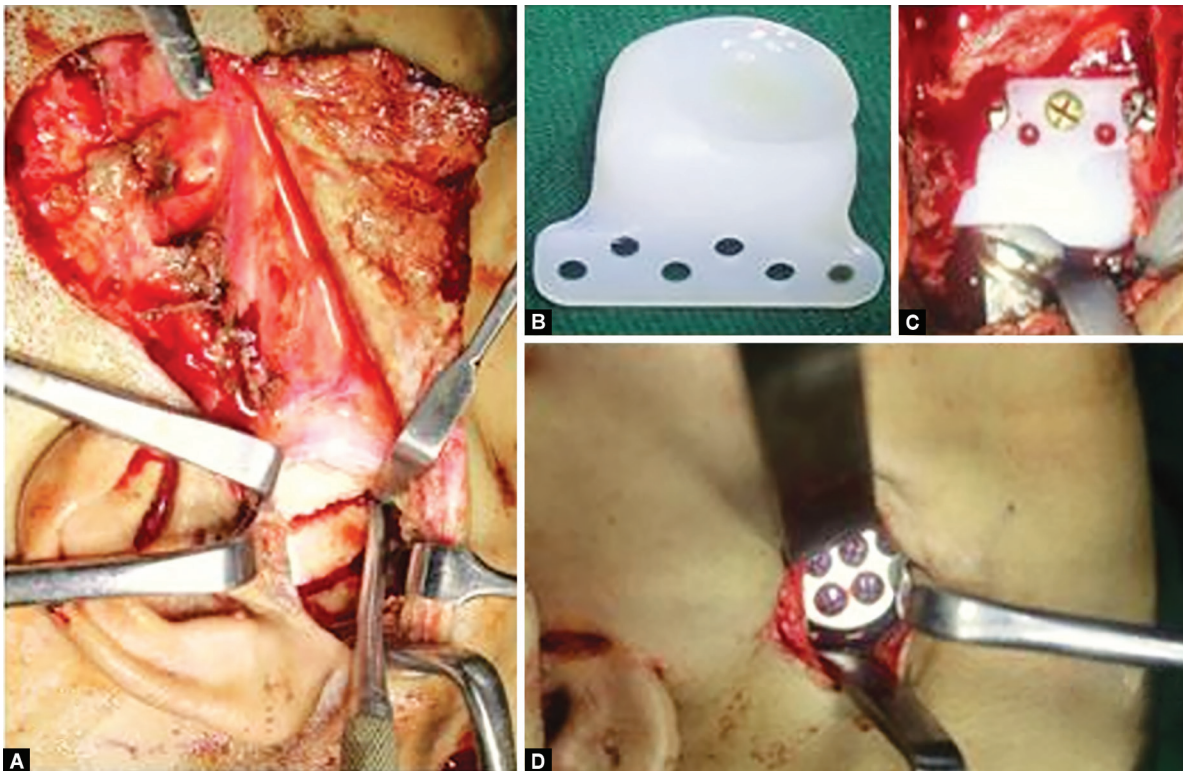
Fig.4: Biomet™ kit

postoperatively, and she was told to visit the doctor annually for assessment.

There was no postoperative infection observed and the skin incisions healed without any disfiguring scars. The patient had mild transient facial nerve weakness (House Brackmann's Grade II) in the right side which resolved spontaneously after 2 weeks postsurgery. Mouth opening was 20 mm at the 1-month follow-up, 27 mm at the 6th month follow-up and 28 mm at 1 year follow-up interval. At the interval of 3 years (Fig. 6), the mouth opening was recorded at 27.5 mm. TMJ functional view (Fig. 6A) and OPG (Fig. 6B) at 3 years interval show good anatomical & functional adaptation. The pain scores were recorded on the visual analogue (VAS) scale (Table 1). Dietary scores showed an improved ability to chew food indicating the improvement in the quality of life. There were no hardware related problems detected clinically or radiographically.

DISCUSSION

Alloplastic total joint replacements have been well researched and extensively used in the field of orthopedics.⁸ The TMJ is a highly specialized joint with potential to cause major physiologic, cosmetic, and psychological disturbances when diseased or when it is not functioning optimally. Alloplastic TMJR devices which mimic the TMJ anatomy have emerged as a valid and viable biomechanical solution for temporomandibular disorders (TMDs). Several studies have highlighted the indications for the use of alloplastic joint replacement which include conditions, such as inflammatory arthritis, recurrent ankylosis, joint pathologies degenerative joint diseases, restricted mouth opening, condylar resorption with loss of vertical height among others.⁹ Although, treatment protocols¹³ have been in place for the treatment of



Figs 5A to D: Operative images: (A) Exposure of ankylosed segment; (B) Fossa component; (C) Fossa component and mandibular component *in situ*; (D) Mandibular component secured





Figs 6A to C: Postoperative: (A) TMJ functional view; (B) OPG; (C) Mouth opening at 3 years follow-up

Table 1: Mouth opening, pain (VAS) scores, facial nerve assessment, dietary scores

Interval	Facial weakness (House Brackmann's grading)	Mouth opening (mm)	Pain score (VAS scale)#	Dietary score*
7 days	Grade II	18 mm	5	5
1 month	Grade I	20 mm	3	4
3 months	Grade I	24 mm	2	3
6 months	Grade I	27 mm	1	3
1 year	Grade I	28 mm	0	3
3 years	Grade I	27.5 mm	0	2

#VAS Scale, mild (1–4) moderate (5–7) severe (8–10); none (0); Pain (0–10 numeric rating scale); *Dietary score; Grade I, chew and eat according to choice; Grade II, chew most things except hard food like apple, meat; Grade III, sticks to soft food like bread, rice; Grade IV, need to cut up food into small pieces; Grade V, only soft, mashed food

ankylosis using autologous grafts, they have disadvantages, such as donor site morbidity, possibly increased length of hospital stay, need for immobilization, functional restrictions, and chances for relapse/re-ankylosis.^{7,14}

Several studies have analyzed the use of different TMJ devices in TMJR procedures (Table 2). Alloplastic stock TMJ devices offer advantages, such as significant pain relief, immediate return to function, possibility for early aggressive physiotherapy, lesser chances of recurrences, better mouth opening, possibility of proper repositioning of the mandible to allow for occlusal harmony, better aesthetics, and in general a better quality of life.^{1,4,9,14,15} Salter in his study has emphasized the importance of early physical therapy to achieve stable long-term functional results. Several studies comparing traditional TMJ ankylosis procedures with total

alloplastic TMJ replacements have shown excellent and comparable results with significant long-term functional improvements.⁷

Westermark treated 12 patients, of which five were diagnosed with unilateral ankylosis and seven with bilateral ankylosis.⁵ He used the Biomet™ TMJ stock prosthesis for TMJ replacement with a follow-up ranging from 2 to 8 years. He achieved an increased mean mouth opening of 30.2 mm postoperatively from 3.8 mm preoperatively which remained stable over the follow-up period. Giannakopoulos et al. in their study with a follow-up period of 3 years showed significant improvements in pain, functions, and mouth opening in 288 patients treated with the Biomet prosthesis between 1995 and 2005.¹⁶ Jones in his study, published in the year 2011, showed significant increase in mouth opening and reduction in pain scores in patients treated with the Biomet TMJ system.¹⁷ These findings were confirmed by the meta-analysis and systematic review conducted by Bach et al. on alloplastic TMJ replacement and possible causes of failure.¹⁰ They also observed that stock devices have lesser risk of revision compared with custom devices.⁹ Although Mercure et al. have published arguments in favor of custom-made prostheses in terms of more accurate anatomical fit and reduced risk of mechanical failure under functional stress, several studies including meta-analyses and systematic reviews comparing stock and custom devices have found no major shortcomings or problems associated with the former.^{9,10}

Limitations of alloplastic TMJ replacement devices include increased cost especially for a custom-made device, infections, need for revision surgeries because of failed components, mechanical failure, breakage of component/screw, loosening of screws, osteolysis, peri-prosthetic bone fractures and heterotopic ossification.¹⁰

The patient gave history of TB a year before the onset of symptoms like reduced mouth opening. TB is one of the oldest

Table 2: Table showing studies with different systems in TMJR procedures

Study and year of publication	Type of system	No. of patients	Diagnosis	Avg. follow-up in years	Mean pain scores variation (VAS)	Mean change in ROM (mm)
Sahdev et al., 2018 ²	Concepts	95	Ankylosis (44%), Inflammatory diseases (23%)	4.4	-1.5	+7.7
Wolford et al., 2003 ²²	Concepts	22	Not recorded	2.75	-3.1	+9.9
Mercuri et al., 2007 ⁹	Concepts	73	Failed implants	11.4	-1.5	+0.4 per postop year
Westermarck 2010 ⁵	Biomet	12	Ankylosis	5	Not recorded	+26.4
Kantas et al., 2011 ²⁰	Nexus	31	Osteoarthritis (35%)	1.75	-4.8	+10.3
Giannakopoulos et al., 2012 ¹⁶	Biomet	288	Not recorded	3	-5.4	+9.1
Sidebottom and Gruber, 2013 ¹⁶	Concepts	74	Degenerative diseases (38%)	1	-6.4	+11
Leandro et al., 2013 ²¹	Biomet	300	Ankylosis (57%)	3.5	-1.2	+30.1
Wolford et al., 2015 ¹⁹	Concepts	56	Not recorded	2.5	-5.4	Not recorded

diseases known to mankind and maxillofacial manifestations form around 10% of all extra-pulmonary occurrences. The presentation of TB in TMJ can mimic features of arthritis, osteomyelitis or other chronic joint diseases and can be challenging to diagnose in the absence of systemic symptoms.¹¹ Although, Ankylotic changes in the joint have not been primarily attributed to TB, the trismus and associated features make ruling out of TB by tests, such as AFB sputum smears, mycobacterium cultures from bone tissues, FNACs, and bone biopsies.¹² TB of the TMJ can be a tricky diagnosis and delays can lead to severe osteo-arthritic changes and joint destruction.¹⁸ Radiology, biopsy, and culture can confirm the diagnosis of a TB infection in the joint. Culture reports may take 6–8 weeks, so histological confirmation can be used as a basis for initiation of anti-TB therapy.¹⁹

CONCLUSION

Orthopedic procedures and treatment modalities would be unthinkable without alloplastic joints, similarly Mercuri states that alloplastic TMJR has the potential to be an integral part of treatment protocols for specific TMJ diseases with effective, reliable, consistent, and good long-term results.⁵ This case report highlights the efficacy of stock TMJ device in the treatment of re-ankylosis cases. The Biomet™ device has proven to be reliable option in planned TMJR procedures. Osteoarticular TB should be ruled out in patients with a history and features of TB.

REFERENCES

- Gerber S, Saeed N. Predictive risk factors for persistent pain following total prosthetic temporomandibular joint replacement. *Br J Oral Maxillofac Surg* 2022;60(5):650–654. DOI: 10.1016/j.bjoms.2021.11.010.
- Sahdev R, Wu BW, Anderson N, et al. A retrospective study of patient outcomes after temporomandibular joint replacement with alloplastic total joint prosthesis at Massachusetts General Hospital. *J Oral Maxillofac Surg* 2019;77(2):280–288. DOI: 10.1016/j.joms.2018.09.002.
- Higginson J, Panayides C, Speculand B, et al. Modification of an extended total temporomandibular joint replacement (eTMJR) classification system. *Br J Oral Maxillofac Surg* 2022;60(7):983–986. DOI: 10.1016/j.bjoms.2022.03.011.
- Rajkumar A, Sidebottom AJ. Prospective study of the long-term outcomes and complications after total temporomandibular joint replacement: analysis at 10 years. *Int J Oral Maxillofac Surg* 2022;51(5):665–668. DOI: 10.1016/j.ijom.2021.07.021.
- Westermarck A. Total reconstruction of the temporomandibular joint. Up to 8 years of follow-up of patients treated with Biomet(®) total joint prostheses. *Int J Oral Maxillofac Surg* 2010;39(10):951–955. DOI: 10.1016/j.ijom.2010.05.010.
- Upadya VH, Bhat HK, Rao BHS, et al. Classification and surgical management of temporomandibular joint ankylosis: A review. *J Korean Assoc Oral Maxillofac Surg* 2021;47(4):239–248. DOI: 10.5125/jkaoms.2021.47.4.239.
- Amarista FJ, Jones JP, Brown Z, et al. Outcomes of total joint alloplastic reconstruction in TMJ ankylosis. *Oral Surg Oral Med Oral Pathol Oral Radiol* 2022;134(2):135–142. DOI: 10.1016/j.oooo.2021.12.121.
- Yadav P, Roychoudhury A, Kumar RD, et al. Total alloplastic temporomandibular joint replacement. *J Maxillofac Oral Surg* 2021;20(4):515–526. DOI: 10.1007/s12663-021-01628-8.
- Mercuri LG. A rationale for total alloplastic temporomandibular joint reconstruction in the management of idiopathic/progressive condylar resorption. *J Oral Maxillofac Surg* 2007;65(8):1600–1609. DOI: 10.1016/j.joms.2006.03.056. Erratum in: *J Oral Maxillofac Surg*. 2008;66(1):208.
- Bach E, Sigaux N, Fauvernier M, et al. Reasons for failure of total temporomandibular joint replacement: A systematic review and meta-analysis. *Int J Oral Maxillofac Surg* 2022;51(8):1059–1068. DOI: 10.1016/j.ijom.2021.12.012.
- Towdur GN, Upasi AP, Veerabhadrapa UK, et al. A rare, unusual presentation of primary tuberculosis in the temporomandibular joint. *J Oral Maxillofac Surg* 2018;76(4):806–811. DOI:10.1016/j.joms.2017.09.010.
- Park HJ, Kim BC, Choi EJ, et al. Tuberculosis of the temporomandibular joint: A case of misdiagnosis. *J Oral Facial Pain Headache*. 2014;28(2):165–170. DOI: 10.11607/ofph.1061.
- Kaban LB, Perrott DH, Fisher K. A protocol for management of temporomandibular joint ankylosis. *J Oral Maxillofac Surg* 1990;48:1145–1151.
- Briceno WX, Milkovich J, El-Rabbany M, et al. Reconstruction of large defects using extended temporomandibular joint patient-matched prostheses. *J Oral Maxillofac Surg* 2022;80(6):1018–1032. DOI: 10.1016/j.joms.2022.01.021.
- Beret M, Nicot R, Gutman L, et al. Quality of life after total temporomandibular joint prosthesis surgery. *J Craniofac Surg* 2022;33(7):2134–2137 DOI: 10.1097/SCS.00000000000008691.
- Giannakopoulos HE, Sinn DP, Quinn PD. Biomet Micro fixation temporo-mandibular joint replacement system: a 3-year follow-up study of patients treated during 1995–2005. *J Oral Maxillofac Surg* 2012;70:787–794. DOI: 10.1016/j.joms.2011.09.031.
- Jones RH. Temporomandibular joint reconstruction with total alloplastic joint replacement. *Aust Dent J* 2011;56:85–914. DOI: 10.1111/j.1834-7819.2010.01288.x.

18. Helbling CA, Lieger O, Smolka W, et al. Primary tuberculosis of the TMJ: presentation of a case and literature review. *Int J Oral Maxillofac Surg* 2010;39(8):834–838. DOI: 10.1016/j.ijom.2010.03.023.
19. Wolford LM, Mercuri LG, Schneiderman ED, et al. Twenty-year follow-up study on a patient-fitted temporomandibular joint prosthesis: The Techmedica/TMJ Concepts Device. *J Oral Maxillofac Surg* 2015;73(5):952–960. DOI:10.1016/j.joms.2014.10.032.
20. Kanatas AN, Jenkins GW, Smith AB, et al. Changes in pain and mouth opening at 1 year following temporomandibular joint replacement – a prospective study. *Br J Oral Maxillofac Surg* 2011;49:455–458. DOI: 10.1016/j.bjoms.2010.07.017.
21. Leandro LFL, Ono HY, De Souza Loureiro CC, et al. A ten-year experience and follow-up of three hundred patients fitted with the Biomet/Lorenz Microfixation TMJ replacement system. *Int J Oral Maxillofac Surg* 2013;42(8):1007–1013. DOI: 10.1016/j.ijom.2013.04.018.
22. Wolford LM, Pitta MC, Reiche-Fischel O, et al. TMJ concepts/ Techmedica custom-made TMJ total joint prosthesis: 5-year follow-up study. *Int J Oral Maxillofac Surg* 2003;32(3):268–274. DOI: 10.1054/ijom.2002.0350.